ABRIDGED

INTEREST TABLES,

—BY—

M. L. EDMUNDS.

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INTRODUCTION.

The importance of a method that can be readily applied in the calculation of interest, has led to the exercise of considerable ingenuity in order to discover the shortest and simplest rule in practice. The object of this work, which gives the method used by the author in the preparation of his Complete Interest Tables, is to present a method for computing interest, not only brief, but one that will give correct interest; this being a feature in which most brief methods are deficient in consequence of reckoning time incorrectly. It may be readily seen that an error arises in the use of all methods for computing interest, whereby the year is reckoned at 360 days, or what is equivalent, at 12 months of 30 days each. Such objection applies to the 6 per cent. method, also to various other methods which by reckoning 360 days to the year, give, for fractional parts of a year, an excess of interest equal to one seventy-third of the entire interest.

There being 365 days in a year, it is impossible to divide the year into months each containing an equal number of entire days; hence the impracticability of reckoning time in months. This difficulty may be obviated by using methods whereby interest is calculated for the number of days. The only correct methods are those by which interest, for periods of time less than one year, is calculated for the exact number of days, and the most practical method is that which by the most natural process, with the least amount of labor, will give exact interest.

Exact interest, obtained by reckoning 365 days to the year, is growing in favor with bankers and other business men, is the method of interest used by the United States Government, and by foreign correspondents, and is the method of interest becoming the most popular and the most commonly used.

In solving problems in simple interest, the primary object is to find the interest on a given principal for a given time and rate. That process which is the most natural and which is the most simple in principle, is to find the interest for one year by multiplying the principal by the rate, and multiplying this interest by the time in years. The objection to this method,

heretofore, has been in the difficulty of multiplying by the time, which given in months and days, has been considered incapable of being reduced to convenient fractional parts of a year. The method by abbreviated multiplication of decimals, presented in this work, enables us to follow the natural process, while at the same time it gives us the shortest method possible for calculating exact interest.

The subject may be conveniently treated under three cases, viz: to find the time; to express the time in years; and, to find the required interest. To this is appended a general rule together with a variety of problems illustrating the method of obtaining, and multiplying by, the decimal years.

The amount of table work, not aggregating one-half page, all of which should be carefully committed to memory, forms a characteristic feature of this method; there being so little required to be memorized in order to compute time readily or to reduce days to decimal years. It should also be observed that if the periods of time, 30, 60, and 90 days, so frequently used, have their respective decimal years memorized, the computation of interest for these periods becomes suscepti-

ble of easy mental calculation. When grace is allowed, calculate for the additional legal number of days.

It is not within the author's province to present a treatise on the fundamental rules of arithmetic; therefore, those who are desirous of perfecting themselves in the method for computing interest, given in this work, should first become familiar with the fundamental operations, also with decimals and with circulates, subjects treated exhaustively in all higher arithmetics.

Having prosecuted the work with the view of facilitating the calculation of interest, the author now submits his method to the candor and discernment of those whose avocations demand a practical treatise on this important subject, and leaves whatever merit the method deserves to the decision of those competent to judge.

M. L. EDMUNDS.

ABRIDGED INTEREST TABLES.

TO FIND THE TIME.

The following table which gives the number of days in the year previous to the first day of each month, should be thoroughly committed to memory.

January.....	0	May.....	120	September .	243
February	31	June.....	151	October. ...	273
March.....	59	July.....	181	November...	304
April.....	90	August....	212	December ..	334

To find the day of the year of any date, add the day of the month to the number in the table corresponding to the month, the sum will give the day of the year. Example: The number in the table corresponding to March is 59, which is the number of days in the year previous to March 1st. The day of the year corresponding to March 10th is found by taking the sum of 59 and 10 which is 69. Hence March 10th is found to be the 69th day of the year.

To find the difference of time between two dates, subtract the day of the year of the former date from the day of the year of the latter date, the

remainder will be equal to the difference of time in days between the two dates. Example: By the table, February 12th is found to be the 43d day of the year, and July 20th, the 201st day of the year. The difference of time in days from February 12th to July 20th is found by taking the difference between 43 and 201 which is 158.

If the dates are in successive years, and the time less than one year, subtract the day of the year of the former date from 365 and add the remainder to the day of the year of the latter date. Example: November 15th is the 319th day of the year. The number of days from November 15th to the close of the year is equal to the difference between 319 and 365 which is 46. February 10th, is the 41st day of the year. Hence, the number of days from November 15th to February 10th is equal to the sum of 46 and 41, which is 87.

If the time exceeds one year, determine the number of entire years, and then reckon the exact number of days remaining.

In passing over February in leap year, add 1 to the number of days found by the table.

TO EXPRESS THE TIME IN YEARS.

Since 1 day is $\frac{1}{365}$ of a year, any number of days will equal the same number of 365ths of a year, and the common fraction thus formed may be reduced to a decimal fraction by annexing ciphers to the numerator of the fraction and dividing by the denominator. Example: Ninety three days equals $\frac{93}{365}$ of a year, and this fraction reduced to decimal years equals $.25\dot{4}794520\dot{}$ years.

The decimal $.25\dot{4}794520\dot{}$, similar to all interminate decimals obtained by reducing any number of 365ths, is a mixed circulate containing the complementary repetend $\dot{5}4794520\dot{}$, which will continue to repeat however far the decimal may be expanded.

In reducing the common fraction to a decimal, it is unnecessary to continue the division further than is required to obtain the first half of the repetend, since the last half may be found by subtracting the terms of the first half respectively from 9. The entire repetend being found, the decimal may be expanded indefinitely by repeating the terms of the repetend. Observe that the repetend should begin with the second figure of the decimal. Example: 90 days equals $\frac{90}{365}$ of a year. An-

nexing ciphers to the numerator of the fraction and dividing by the denominator, continuing the division five decimal places, gives .24657, and we have 2, the finite portion of the decimal, and 4657, the first half of the repetend. Subtracting the terms of the first half of the repetend respectively from 9, to obtain the terms of the last half, we have the mixed circulate .246575342̇, which may be expanded indefinitely by repeating the terms of the repetend; thus, .246575342465 etc. When the number of days is a multiple of 5 the repetend will begin with the first figure of the decimal; but to preserve uniformity in practice, regard the second figure of the decimal as the first figure of the repetend.

As the number of decimal places ordinarily required is from three to five, the above principle of circulates is employed to expedite the process of reduction only when interest is required on extremely large amounts.

In every instance the reduction may be much more rapidly performed if the following table be committed to memory.

365 x 1= 365	365 x 4=1460	365 x 7=2555
365 x 2= 730	365 x 5=1825	365 x 8=2920
365 x 3=1095	365 x 6=2190	365 x 9=3285

TO FIND THE INTEREST.

Example: Required the interest of $3,987, for 5 years and 316 days, at 5 per cent.

The time expressed decimally equals 5.86575-|- years.

OPERATION.

$3987=Principal.
.05=Rate.

199.35=Interest for 1 year.
57568.5=Time expressed decimally.

996.75=Interest for 5 years.
159.48=Interest for 8 tenths of a year.
11.96=Interest for 6 hundredths of a year.
1.00=Interest for 5 thousandths of a year.
.14=Interest for 7 ten-thousandths of a year.
1=Interest for 5 hundred-thousandths of a year.

$1169.34=Required interest.

Multiplying the principal by the rate gives the interest for one year, and this interest multiplied by the time in years gives the required interest.

Since the interest is generally desired only in dollars and cents, the process of multiplying by the time in years expressed decimally, may be shortened by contracting each partial product to the desired denomination.

Multiplying the principal \$3987 by the rate .05 gives \$199.35 interest for 1 year, and this interest, divided by 10, 100, 1000, etc., will give \$19.93-|-, \$1.99-|-, \$0.19-|-, etc., which equal the interest respectively for 1 tenth of a year, 1 hundredth of a year, 1 thousandth of a year, etc. By writing the terms of the decimal years,which are years, tenths of a year, hundredths of a year, thousandths of a year, etc., respectively under the right hand terms of the interest for 1 year, 1 tenth of a year, 1 hundredth of a year, 1 thousandth of a year, etc., we have the terms of the decimal years written in an inverted order, each properly written under the interest which must be multiplied by it. This arrangement enables us to contract each partial product to the required denomination, and to reject all partial products of a lower denomination than required in the entire product.

Multiply the interest for 1 year, 1 tenth of a year, 1 hundredth of a year, 1 thousandth of a year, etc., respectively, by the number of entire years, tenths of a year, hundredths of a year, thousandths of a year, etc., increasing each partial product by as many units as

would have been carried to it from the product of the rejected terms, and 1 more when the second term towards the right in the product of the rejected terms is 5 or more than 5; and place the right hand terms of these partial products in the same column. The sum of these partial products will be the required interest.

The rejected terms are the denominations lower than cents, in the interest for 1 year, 1 tenth of a year, 1 hundredth of a year, 1 thousandth of a year, etc.

The terms of the decimal years must be extended one place farther to the left than the number expressing the interest for one year, in order to obtain the last partial product which is equal only to the number of units that would have been carried from the product of the rejected terms.

GENERAL RULE.

1. Multiply the principal by the rate to find the interest for 1 year.

2. Write the number of entire years which must not exceed 9, under that part of the interest for 1 year, generally cents, which is of the lowest denomination required in the entire interest. If the time is less than 1 year, place a cipher for the first term of the decimal years. If the number of entire years exceeds 9, write for the first term of the decimal years, a column of figures whose sum equals the whole number of entire years.

3. At the right of, and near to the number of years, write the number of days remaining, to which annex ciphers and reduce to tenths of a year, hundredths of a year, thousandths of a year, etc., by dividing by 365; and write the number of tenths of a year, hundredths of a year, thousandths of a year, etc., in a reverse order at the left of the number of years, extending the terms of the decimal years, when interminate, one place farther to the left than the terms of the number expressing the interest for 1 year. The divisor which is always 365, also the products of 365 by the quotient figures, may be written or unwritten, according to ones familiarity with the process of reduction. If the divisor is written, place it on the right of the number of days.

4. Regard the interest for 1 year divided by 10, 100, 1000, etc., which will give the interest respectively, for 1 tenth of a year, 1 hundredth of a year, 1 thousandth of a year, etc.

5. Multiply the interest for 1 year, 1 tenth of a year, 1 hundredth of a year, 1 thousandth of a year, etc., respect-

ively, by the number of entire years, tenths of a year, hundredths of a year, thousandths of a year, etc., increasing each partial product by as many units as would have been carried to it from the product of the rejected terms, and 1 more when the second term toward the right in the product of the rejected terms is 5 or more than 5; and place the right hand terms of these partial products in the same column.

6. Add these partial products; the sum will be the required interest.

EXACT INTEREST MAY ALSO BE RECKONED BY THE FOLLOWING RULE.

Multiply the principal by the rate, and this product by the integral number of years; then multiply the interest for 1 year by the exact number of days remaining and divide by 365; and take the sum of the two results.

EXAMPLES.

EXAMPLE 1.

Required the interest of $225, for 2 years and 40 days, at 8 per cent.

OPERATION.

$225
.08

18.00
5901.2 40.0(365
36.00 365
1.80 3500
16 3285
1 2150

$37.97 Ans.

EXAMPLE 2.

Required the interest of $256.75, for 93 days, at 5 per cent.

OPERATION.

$256.75
.05

12.8375
7452.0 93.0
730
2.57
.64 2000
5 1825
1 1750
1460
2900

$3.27 Ans.

EXAMPLE 3.

Required the interest of $600, for 14 years and 22 days, at 12 per cent.

OPERATION.

$600
.12

72.00
8
2060.6 22.00
1000
576.00
432.00
4.32
1

$1012.33 Ans.

EXAMPLE 4.

Required the interest of $60.25, for 5 years and 73 days, at 7 per cent.

OPERATION.

$60.25
.07

4.2175
2.5 73.0

21.09
.84

$21.93 Ans.